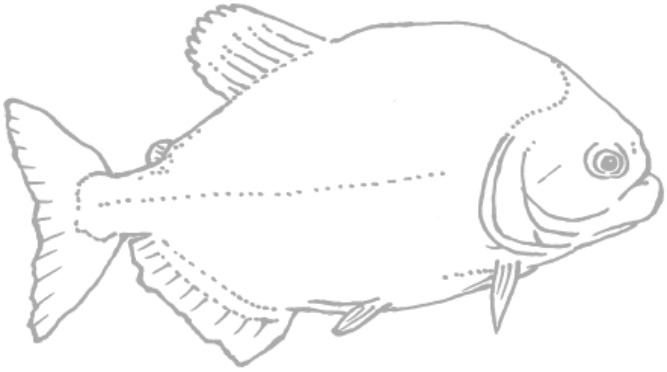
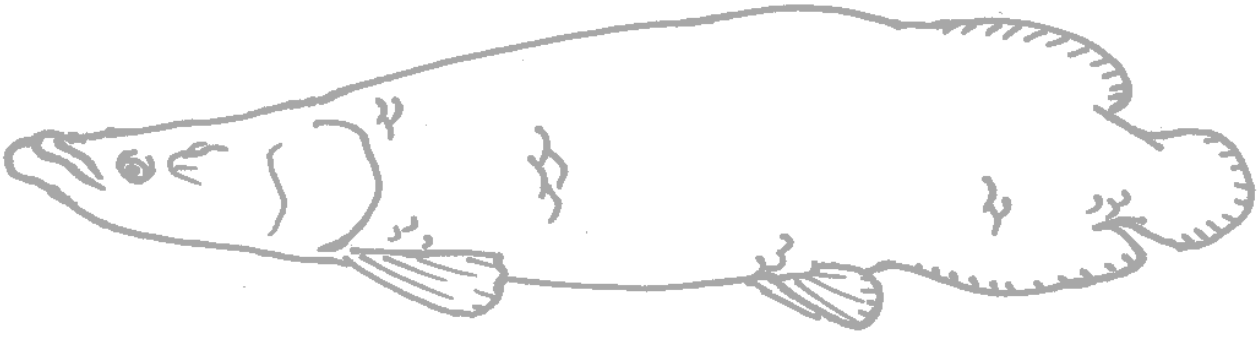
Anatomy of the Rainforest
Classroom Activities

PRE VISIT ACTIVITIES
These classroom activities will help prepare your students for the upcoming Aquarium visit.

Name tags
Help our volunteer educators get to know your students. Have your students create name tags for their visit to the Aquarium. Your class can colour and cut out these shapes and write their names on them in large print.





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Anatomy of the Rainforest
Classroom Activities

Where is the Amazon Basin?

The Amazon Basin is massive, covering more than seven million square kilometres. Have your students locate the Amazon Basin on a map.

1. What countries in South America share the Amazon Basin?
2. What are the largest cities in the Amazon region?
3. Are these cities located near a tributary of the Amazon River?
4. Have the students locate the equator and note how it divides the Basin. Ask your class to think about the effect of the equator on the Amazon Basin.

How large is the Amazon River?

Over 1,100 tributaries form the Amazon River system. Together these rivers are known as the Amazon River, the largest river in the world.
The sources of these tributaries are located throughout the northern and southern highlands and in the Andes Mountains, approximately 6,500 kilometres from the Amazon's 400-kilometre-long mouth at the Atlantic coast. At peak flooding, the Amazon River pours 20 trillion litres of fresh water per day into the Atlantic Ocean.

Have your students compare the Fraser River with the Amazon. Use a map to locate the mouth of the Amazon River. Trace the course of several major tributaries from their sources to the ocean.

How hot is a tropical rainforest?

Tropical rainforests show little climatic variation. They are perpetually warm and wet. For a tropical rainforest to exist, certain conditions must remain constant. Humidity hovers at 95 percent and never drops below 70 percent. Temperatures range between 24°C and 32°C and do not vary greatly from night to day.

Rain falls daily in the Amazon Basin and is essential to the tropical rainforest. It can exceed 12,000 millimetres per year in this region. Rainy seasons alternate months north and south of the equator. In areas south of the equator, the rains are particularly heavy between September and April, while in the north, the heaviest rains occur from May to August.
The sun's strong equatorial rays beat down on the forest causing huge quantities of water to evaporate. This vapour, which equals trillions of litres each day, rises and condenses into clouds, recycling the water and providing new rains.

Have your class compare these conditions with the temperate climate they have experienced in coastal B.C. Identify other tropical rainforests.

1. What are the geographical boundaries limiting tropical rainforest?
2. How do the water and gas cycles of tropical forests effect the global climate?

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Anatomy of the Rainforest
Classroom Activities

POST VISIT ACTIVITIES

These classroom activities will help reinforce themes introduced during your Aquarium visit.

1. Threads in the Web

Each student becomes an expert on a different Amazonian plant or animal. When your students have completed all of their research projects, they can pool their knowledge and weave a food and habitat web based on what they have learned.

Objectives

- investigate the optimal requirements necessary for a living organism
- describe the environmental conditions in the major biomes
- compare and contrast how various organisms have adapted to the conditions in each biome and how these organisms interact
- use efficient strategies for locating, recording and organizing research information from a variety of sources
- organize, interpret and make generalizations using details and information about material they have read, heard, or viewed using a variety of written or graphic forms
- critique the hypothesis that the Earth is like a living organism

Materials

- paper
- string
- tape
- resource materials

Steps

1. Students research the animal or plant of their choice, writing a comprehensive report about where the organism lives, how it is adapted to survive there, what it eats, how it protects itself from being eaten, how and when it reproduces and protects its young, and what happens to its body when it dies (how it is recycled).
2. Have each student draw their organism in the centre of a large piece of flip-chart paper. Tape all the pieces of paper on a wall and attach pieces of string between the plants and animals to illustrate how they are interconnected. Who eats who? Make other sheets of paper available for habitats and organisms that may not already be posted on the wall.

These connections grow into food webs. These interconnections illustrate how the rainforest is a living system of plants and animals that are interdependent and closely linked together.

Ask your students to draw some conclusions based on the interdependencies of these organisms. What would happen if their organism were removed from the rainforest? What does their organism require to survive?

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Anatomy of the Rainforest
Classroom Activities

2. Diversity in the Rainforest

Compare the biological diversity of temperate and tropical rainforests by sending your class into a local habitat to carry out a few observations and make a few elementary calculations. Then send them to the library to perform the same type of research about a tropical rainforest. How do the results compare?

Objectives

- understand the concept of biological diversity and specifically the type of diversity found in small samples of local coastal forest and tropical rainforests
- compare and contrast how various organisms have adapted to conditions in each biome and how these organisms interact
- identify the purposes and audiences for their communications
- create a variety of academic, technical and personal communications, including personal essays, oral and written reports and informal dramatizations
- interact purposefully, confidently and appropriately in a variety of situations
- acknowledge and paraphrase views that differ from their own and reassess their own viewpoints

Materials

- pens
- paper for recording observation
- clipboards
- tape measures or 3-metre lengths of string
- nature guide books (optional)

Steps

1. Use this activity to begin a discussion about biological diversity. If possible, take your students outdoors to a natural setting near your school. Divide your class into small groups of five-to-six students and have each group mark out a plot of three square metres using a tape measure and lengths of string.
2. Have your students count the number of different species of plants they can find in their plots. They may want to arrange the plants into categories: angiosperms, conifers, ferns, mosses, lichens. Have your students repeat this two or three times with new plots. Then have them walk along a short section of forest trail and tally the number of different species of birds they can see or hear. You can give your students guide books and ask them if they can identify any species. Useful guides include:
   Peterson, Roger Tory. 1961. *A Field Guide to Western Birds.* Boston: Houghton Mifflin Company.
   Pojar, Jim and Andy MacKinnon, Eds. 1994. *Plants of Coastal B.C. including Washington, Oregon and Alaska.* Vancouver: Lone Pine Pub.
3. Discuss the following questions with your class.
   - Do our temperate rainforests have relatively high or low diversity of species? *Our local rainforests have a low diversity of species.*

Anatomy of the Rainforest
Classroom Activities

- How does the diversity of the temperate rainforest compare to that of the tropical rainforest? *Tropical rainforests display a much, much higher diversity of species than temperate rainforests do.*
- Would you expect more highly specialized organisms in an ecosystem with high or low diversity? *A greater number of specialized organisms would live in an area with higher diversity.* Why? *There would be more specialized habitats for these organisms to colonize.*
- How are the aims of conservation best carried out in a low diversity area versus a high diversity area? For example, would a few large reserves or many small reserves be more appropriate for temperate or tropical rainforests? *Larger reserves may be needed in a tropical area where individuals of the same species are spread further apart, but sometimes it is difficult to make useful generalizations. Grizzly bears, for example, require large territories in order to survive in temperate habitats.*
- Is it more important to preserve species or an ecosystem? *It is difficult to preserve a species without preserving the habitat it lives in.*

Temperate Rainforests
Rainfall: Generally more than 2,500 millimetres of rain falls each year.
Most of the rain occurs in B.C.'s forests during the winter months.

Temperature: Our coastal rainforests experience seasons characteristic of the Earth's temperate regions. Summers are relatively warm and dry, and winters are mild and wet. These forests seldom experience sub-freezing temperatures.

Light: Day length and light intensity vary throughout the year.
Growing season: The growing season takes place during the warmer months only—from April to October.

Nutrients: In temperate rainforests, the soil is one-to-two metres deep and holds plenty of mineral nutrients. These soils are young by geological standards, having been created since the last Ice Age. They have only been weathered and rain washed since that time, and as a result are still rich in minerals and nutrients.

Plants can also easily access water deep in the soil, if the weather is dry. These deep, nutrient-rich soils and readily accessible waters give plants with deep, penetrating roots an advantage, and many temperate trees grow such roots.

During the dormant, non-growing season, many nutrients accumulate on the ground. These nutrients are gradually released from decaying materials and are taken up by vegetation during the growing season.

Biological diversity: Temperate rainforests are composed of many individuals of only a few species. A two-hectare plot in coastal B.C. may contain only seven species of trees and would likely be dominated by two or three species. Numbers of animal species are correspondingly low.
Forest structure: Climax temperate rainforests are typically composed of a relatively open undergrowth which includes mosses, ferns, herbs, shrubs and large

conifers which can reach a height of 80 metres. Epiphytes are usually restricted to a few species of lower plants: lichen, mosses and ferns.

Forest succession: Natural succession in a coastal rainforest typically follows fire and involves the recolonization of large areas with a few species of herbs, flowering plants, shrubs, deciduous trees and a series of conifers, maturing to a forest dominated by the one or two climax species.

Major causes and effects of deforestation: The major cause of deforestation is commercial logging. A mature coastal forest can re-grow on logged soil in about 400 to 500 years with careful logging practices.

Tropical Rainforests

Rainfall: Generally over 2,500 millimetres of rain falls each year. There are seasonal variations in rainfall in tropical rainforests, but humidity in moist lowland rainforest is always high.

Temperature: Temperatures do not vary through the seasons.
Light: Day length and light intensity are constant in the equatorial regions, and vary slightly further away from the equator.

Growing season: Tropical forests experience a constant growing season.

Nutrient uptake: Mineral salts are available near the surface because the layer of dead leaves on the forest floor is quickly broken down by cockroaches, termites, earthworms, fungi and bacteria. The constant, rapid decay and growth of organisms has caused tropical plants to develop the ability to take up nutrients rapidly.

Nutrients do not accumulate in soils in tropical rainforests, as they are mostly tied up in living material. Most rainforests of the world grow on thin soil layers which are poor in mineral salts. Tropical soils are usually much older than those in the temperate rainforests and huge quantities of water have passed through them, washing away most of their nutrients.

Biological diversity: Tropical rainforests are characterized by large numbers of species, each represented by only a few individuals. For example, a two hectare plot of forest may contain 100 trees, each of a different species. Animals species are correspondingly high.

Forest structure: Mature tropical rainforests are typically composed of a relatively open undergrowth of flowering plants, herbs and shrubs with ascending layers of larger trees forming a canopy and an emergent layer up to 50 metres above ground. Large numbers of species of lianas and epiphytes, including orchids and bromeliads, are also characteristic of tropical rainforests.

Forest succession: Natural succession in tropical rainforests usually occurs in small, sunny gaps where trees have fallen. A large number of species of shrubs and vines

begin the recolonization and are followed by a series of species of trees until a mature, highly mixed forest replaces the gap.

Major causes and effects of deforestation: Logging, cattle ranching, mining and the damming of rivers all cause deforestation. Soil infertility and erosion follow tropical deforestation and frequently make areas incapable of supporting a rainforest again. No one knows how long it takes to regenerate a mature tropical forest or the maximum size or optimum patterns of clearing which would allow complete recolonization of flora and fauna, if this is possible.

Anatomy of the Rainforest
Classroom Activities

3. Rainforest Forum: Small Group Debate Grades 5-8

Students investigate existing and vanished tropical rainforests and hold a forum to discuss the reasons for conserving or developing these habitats.

Objectives

- understand the complexity of rainforest deforestation, its causes and effects and discover possible solutions
- describe and attach value to an ecosystem
- relate the growth and survival of a variety of animals to different conditions
- describe organisms in terms of their roles in food webs and how they interact with each other
- collect, display, interpret, record and present information in a comprehensible manner
- compare and contrast the practical, ethical and economic dimensions of population growth and polluted environments
- evaluate how major natural events and human activity can affect local and global environments and climate change
- identify gaps in information
- organize and structure information in a variety of literary, expository, persuasive and other forms

Materials

- flip chart paper and pens for each group of students

Steps

1. Have your students research existing and historic rainforests by diving into the history and biology of these habitats. Ask your students to review historic accounts to discover how the habitat was viewed and used during both the past and the present. Encourage your class to use resources including old newspaper stories, library resources, and text books.
2. Have your students analyze how these rainforests have changed over time. What has caused these changes? Has the loss of particular habitats or species changed the nature of the entire rainforest? What positive changes can they see in the public's attitudes?
3. Divide your class into groups of five-to-six students each. Have each group use large sheets of paper to write lists describing the challenges facing rainforest conservation.
4. Have each group present their ideas to the rest of the class about challenges to rainforest conservation.
5. Have your students return to their small groups and brainstorm about solutions for rainforest conservation.
6. Have each group present their conservation solutions to the rest of the class. Follow with a class discussion. Have students pledge to implement one or more solutions which have been discussed.

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Anatomy of the Rainforest
Classroom Activities

4. Watching my Waste-Line

In this activity, students will record how much daily waste is produced in the classroom and work towards reducing their impact on the environment.

Overview of Activity:

1. After lunch, empty the garbage can in the classroom, and make a list of the types of garbage (e.g. plastics, juice box, paper, food, etc.) and the amounts of each type of garbage. Chart and total this amount.
2. Discuss where the garbage will go (to the dump? to a landfill?) and how garbage can affect the environment. Ideas that should come up include:
    - Animals eat it and get sick
    - Animals get caught in it and die
    - Chemicals get into the environment
    - It takes up space and habitat
3. Look at your immediate area, too. Are there enough garbage bins in the schoolyard? How does the garbage get removed? Is the movement of the garbage a source of pollution that needs attention? Does schoolyard garbage get into local streams?
4. Discuss how we can reduce the waste we produce. Ideas might include:
    - Recycle material
    - Reuse plastic bags (or use cloth bags)
    - Buy items with less packaging
    - Use reusable containers
5. Take out any recyclable material (paper, cans, juice boxes, etc.) and arrange to have them recycled. Total the remaining amount of waste. Compare this to the original amount. How much waste could have been reduced?
6. Challenge the class (or the entire school) to reduce their waste by having a Litterless Lunch (see following lesson plan). Check every week and chart their progress. Make a sign that shows the amount of waste that has been reduced. For example, "Since September 6th, we've reduced our waste by 42%!!"
7. As an extension, consider looking at the community as a whole and methods to reduce waste as a community. How can students encourage the community to reduce waste, reuse and recycle?

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Anatomy of the Rainforest
Classroom Activities

5. Litterless Lunch

Parents often pack lunches with disposable plastic bags, aluminum foil, or wax paper, or they purchase single-serving items, such as fruit cups or juice boxes. Much of the trash we generate comes from food packaging, and lunch foods are no exception.

In fact, it is estimated that on average a school-age child using a disposable lunch generates 67 pounds of waste per school year (www.wastefreelunches.org). An old-fashioned "brown bagger" can conceivably dispose of over 14, 000 paper lunch bags in their lifetime (www.saveonfoods.com).

A litter-less lunch is one where nothing needs to be thrown away. For example, a student could pack a lunch in a reusable lunch box or cloth bag with re-usable plastic containers.

Activity

1. Eat lunch in the classroom on a rainy day, and ask students to measure the amount of waste.
2. Discuss what it means to create a lunch with no waste. Why is it important?
3. Brainstorm with the class what a litterless lunch looks like?

   Avoid:
   - × Brown paper bags
   - × Plastic sandwich bags
   - × Disposable single servings
   - × Styrofoam cups
   - × Individually packaged snacks

   Instead choose:
   - ✓ Reusable lunch kits or bags
   - ✓ Reusable plastic containers: Divide a larger batch of snacks or a large container of yogurt into your own single servings.
   - ✓ Reusable drink bottles: Buy larger sizes or concentrated forms of beverages and dispense them into your own refillable thermos or drink container.
   - ✓ Snacks in minimal wrapping
   - ✓ Recycling: Return your deposit container at a redemption centre. Place your clean metal, rigid plastic, plastic bags, paper, and cardboard in the blue bins at Recycling Depots around the region.
   - ✓ Pack a cloth napkin instead of a paper napkin.
   - ✓ Pack stainless-steel utensils instead of using disposable plastics.
   - ✓ Compost your fruit and vegetable scraps. Take them home or consider setting up a worm composting bin at school.

4. Select a day to have a litterless lunch in the classroom. Send a letter home informing parents about the day and possible lunch alternatives.
5. Measure the waste, and compare it to the lunch waste before the class discussed the importance of a litterless lunch.

Follow up activities:

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Anatomy of the Rainforest
Classroom Activities

- Ask students to create a collage of things that create a litterless lunch.
- Have the students set a personal goal regarding their lunches, and create a chart so they can track it for a period of time.
- Compose a litterless lunch song or story about how they can make a difference.
- Write about how students can help reduce the litter in their lunches at home.

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Anatomy of the Rainforest
Classroom Activities

6. Dear Aquarium Volunteer

Have your students write letters, with pictures, to the Aquarium Volunteer Educators who teach the Anatomy of the Rainforest School Program. Your students can tell the Volunteers what they like most about what they saw, touched or heard during their program. Aquarium Volunteers love to receive mail.

Objectives:

- Practice general language arts written skills
- Learn about the physical characteristics and behaviour of a variety of animals
- Teach the value of direct observations
- Reinforce what the students learned during their Aquarium program

Materials:

- Story books
- Pencils, crayons
- Paper
- Large envelope for all the letters and pictures
- Postage

Steps:

1. Discuss your students' visit to the Vancouver Aquarium. What did your students learn? What did they learn that they didn't know before? What surprised them the most? What animal inspired them to learn more about?
2. Have the class read about the ocean.
3. Ask your students to write letters and/or draw pictures to the Volunteers. What did the students like most? What did they learn?

Address:
Volunteer Educators
Vancouver Aquarium
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Canada
V6B 3X8

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